ANNUAL REPORT
OF THE
TESTING DIVISION
(LABORATORY)
NEW JERSEY STATE HIGHWAY DEPARTMENT
FOR THE YEAR
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ANNUAL REPORT - 1949

TESTING DIVISION
(LABORATORY)

The importance of the Testing Laboratory as a unit of our Highway Department can not be too strongly stressed, and its work in developing proper specifications for materials used in highway and bridge construction and the methods of testing the same should be given every support to have it properly equipped and manned with efficient personnel to carry on this work. The importance of specifications for materials of all kinds to insure their being of the proper quality and grade for a given purpose and of uniform methods of testing to qualify them has been long recognized.

The first organized meeting to discuss the subject of uniform methods of testing, which is beginning to assume considerable importance in industry, was held in Europe in 1882. There was subsequently formed an International Association for Testing Materials, and in 1898 an American Section of this Association was organized. After a short time, it became evident to the American members that an independent organization could best carry out the important standardization of specifications and methods of testing and research work in this country, and in 1902 the present American Society for Testing Materials was incorporated. The slogan of purpose adopted by this Society is: "The Promotion of Knowledge of the Materials of Engineering and the Standardization of Specifications and the Methods of Testing." This clearly defines the importance placed on such standardization.

That part of the work in this Society dealing with the "Promotion of Knowledge of the Materials of Engineering" is effected through investigations and research by committees and individual members of the Society and by joint research with other groups, the results of which are presented as papers, reports and discussions at annual meetings of the Society and then subsequently published. The "Standardization of Specifications and the Methods of Testing" is carried out chiefly by technical committees, each of which has under its jurisdiction engineering materials in a definitely prescribed field or some specific phase of materials testing. Materials used in highway and bridge construction are included in the work of this Society. The membership is drawn from many of the more important industries of the country. The members may be roughly classified into three groups: consumers of raw materials, semi-finished and finished products (highway departments come within this classification); producers of materials; and a general interest group, comprising engineers, scientists, educators, testing experts, research workers, etc.

I have been designated by our Department as their representative on several of the committees of this Society dealing principally with the various types of materials which are used in highway and bridge construction. At the present time, I have the very great honor of being Chairman of the very important COMMITTEE D-4 ON ROAD AND PAVING MATERIALS, whose scope is: "The formulation of specifications, methods of test and definitions of terms pertaining to road and paving materials." I also take a very active part in the work of several of the sub-committees making up this Main Committee. I also represent the Department on several other very important committees of this Society, which are as follows:

C-1 ON CEMENT. The scope of this Committee is: "Hydraulic cements, such as portland cements of various types, natural cements, possuloanic cements, masonry cements, slag cements, and various modifications of foregoing and/or combinations during manufacture thereof with one another or with other materials; specifications, methods of test, investigation of properties of cements with relation to specification requirements; promotion of uniformity and improvement in testing cement through the sponsorship of the Cement Reference Laboratory, a joint project of the Government and the Society."

C-9 ON CONCRETE AND CONCRETE AGGREGATES. The scope of this Committee is: "The assembling and study of data pertaining to the properties of portland cement concrete and its constituent materials; the formulation of standard specifications for the constituent materials of concrete (except portland cement) and for concrete itself."

C-13 ON CONCRETE PIPE. The scope of this Committee is: "The formulation of specifications, methods of tests for concrete pipe (reinforced and unreinforced) used for constructing sewers, culverts and for irrigation."

D-1 ON PAINT, VARNISH, LACQUER, AND RELATED PRODUCTS. The scope of this Committee is: "Paint, varnish, lacquer and related products, and materials used in the manufacture thereof." I am a member of Sub-Committee IV of this Main Committee whose scope is the development of specifications and methods of testing paints for use as traffic line markers or separators on highways. Our State is particularly interested in this type of paint, and, through the work of this Sub-Committee, we are able to gain invaluable information for the development of a specification for the best type of paint it is possible to produce with our present-day knowledge.

D-18 ON SOILS FOR ENGINEERING PURPOSES. The scope of this Committee is: "The formulation of specifications and methods for the sampling and testing of soils for engineering purposes, the selection of acceptable nomenclature and definitions, and the promotion of research activity in the general field of properties and behavior of soils for engineering purposes."

Some 50 years ago, the Federal Government created an agency known as the "Office of Road Inquiry", to "Investigate and Teach Post-Road Construction". In 1901, it established a road making testing laboratory and began a study of the qualities of available road making materials that in time encompassed practically every type of material to be found in all parts of the country and led on to the earliest studies of new and untried methods of road building with bituminous and cement binders.

On December 12, 1914, there was founded in Washington, D.C. the Association of State Highway Officials which, to date, is still very active. As the title infers, the membership is composed of officials of the various state highway departments in the United States, the District of Columbia and the Bureau of Public Roads of the Federal Government. At the time of the founding of this Association, hardly half the states had effective highway departments. However, this Association took a very active part in and was largely responsible for the enactment of the first Federal Aid Road Act of July 11, 1916.

This Association recognized very early in its life the desirability of having uniform standard methods of testing which could be used by all of the testing laboratories affiliated with the Association. In an attempt to accomplish this, there was organized early in 1909, a COMMITTEE ON TESTS AND INVESTIGATION under the sponsorship of Professor T.R. Agg, of Iowa State College. This Committee held its first meeting at the Bureau of Public Roads in Washington and adopted tentatively certain recommendations regarding methods of sampling and testing which were published in U.S. Department Agricultural Bulletin 949. This Committee is now known as the COMMITTEE ON MATERIALS of this Association. Through the efforts of this Committee, the original series of standard methods has been extensively revised and enlarged until at the present time 107 methods of testing, covering practically all materials used in highway work, have been adopted by this Association.

The Association has likewise been active in the preparation of specifications for materials for highway and bridge construction. One hundred and three (103) specifications have been adopted up to the present time covering such materials as stone, slag and gravel for various types of macadam construction, fine and coarse aggregates for concrete, portland cement, asphalts, tars and numerous miscellaneous materials.

There are many other agencies interested one way or another in the field of highway and bridge construction, such as:

(a) The Highway Research Board which has been organized under the auspices of the Division of Engineering and Industrial Research of the National Research Council. Its purpose is to provide a national clearing-house for highway research activities and information. In its practical workings, the Board provides a forum for the discussion and publication of the results obtained by individual research workers organized as committees of experts to plan and suggest research work and to study and correlate the results, publishes and otherwise disseminates information, provides a research information service and carries on fact-finding investigations. It also maintains a highway research correlation research service, the function of which is to aid the many highway research agencies to correlate their work through personal visits, conferences, committee work and distribution of pertinent information.

(b) The American Concrete Institute, whose primary objective is to assist its members and the engineering profession generally by gathering and disseminating information about the properties and application of portland cement concrete and reinforced portland cement concrete and their constituent materials.

(c) The American Road Builders' Association, which was organized in 1902, directs its efforts to technical, scientific and educational work concerning highway and bridge construction. The activities of the Association are dedicated to the accomplishment of a continuing highway program on a reasonably adequate scale and technically sound basis and a high business plane.

(d) The Association of Asphalt Paving Technologists, whose object is the advancement of the technology of asphalt pavement construction which includes the production and testing of materials entering into this type of construction.

There are many other agencies such as mentioned above who are doing very active work for the purpose of building better highways and pertinent structures.

The State of New Jersey, through its then Public Roads Department, recognized the necessity of standard specifications and methods of testing materials for use in highway construction, and in 1909 established a laboratory for this purpose, the organization of which, at that time, was made up of myself and the Director, Mr. R.B. Gage. This organization has grown to its present personnel of some 80 employees, and every penny spent for its operation since its inception has been very well expended, as it has given assurance to our Department and the taxpayers of our State that a most serious attempt has been made to see that the best possible types and grades of materials have and are being used. The magnitude of the work done by this Laboratory and the accomplishments thereof might better be understood if it were realized that there are some 40 or more various types of materials which we must inspect that are used in the various phases of our highway and bridge construction. The variety of these materials is such that we are not always able to develop specifications for them through our own efforts because of our lack of physical facilities, but we are able to do so by keeping our contacts with the types of associations and agencies mentioned above.

The rather concise bibliography given above has been for the purpose of emphasizing very emphatically the need for maintaining our Laboratory at the highest standard. The demands upon our facilities are increasing at all times, and, for this reason, I would respectfully request that an investigation be made of our physical facilities for the purpose of expanding the same so that we may be able to take care of the increased amount of work we are required to do and to further enable us to conduct more research work which we are not able to do at the present time with our present physical facilities and personnel. I have certain ideas in mind for this physical expansion which I hope to be able to present to you in the near future for your consideration for providing sufficient funds in our 1951-52 Budget for this purpose.

Appended to this report is a series of photographs with an accompanying legend showing some of the conditions existing at the Laboratory with respect to the lack of space necessary to perform the work required.

I. LABORATORY ACTIVITIES

This year was one of increased activity in the work performed by the Laboratory, which is best understood by reviewing the work done by each of the sub-divisions comprising the organization of the Laboratory, as reported hereinbelow:

During the year, 20,200 samples of various types of materials were received, which involved the performing of some 85,000 tests which was an increase of approximately 42% more samples and 43% more additional tests made than for the preceding year, 1948.

The increase in personnel was mostly responsible for the proper handling of this increase. However, numerous changes, generally of minor nature, have been made to eliminate unnecessary details and reduce the clerical work in recording and reporting necessary information. As the newly acquired personnel is mostly on a temporary Civil Service status, they have been given general

training in various laboratory procedures and, to some degree, in the field of assignment. When permanent appointments are made, we hope to provide a flexible organization capable of taking care of emergencies and suitable for advancement to positions which would become vacant through retirement or death. In addition to the newly acquired personnel, we still further need about eight (8) more persons added to our organization, which would then enable us to carry on some of the research work and investigations that we should be doing at this time.

II. ENGINEERING SUB-DIVISION

This Sub-Division is charged with the responsibility of testing and conducting research and investigation on all materials used in portland cement concrete pavements and structures, which includes coarse and fine aggregates, portland cement, water, and reinforcing steel, in addition to brick, concrete block, various kinds of castings, etc. During the year, this Sub-Division received, tested and reported on 13,681 samples, involving some 63,000 individual tests. A breakdown on the number and kinds of samples received and handled is included in a Statistical Supplement accompanying the report of this Sub-Division which should aid the reader in locating any desired information. A general summary is given covering the activities of each of the sections comprising this Sub-Division.

Portland Cement and Concrete Sand Section

This Section tested 2,725 samples which required 35,502 tests. Of the above total number of samples, there were 1,500 samples of Portland Cement Type II, Type II-A, and White Cements. These represented 734,600 bbls., of which 18,800 were rejected.

In addition to the above normal routine tests accomplished by this Section, the measurement of growth of 1" x 1" x 10" mortar bars (see Laboratory Investigation 44-2) was continued. Cooperative tests were also carried on with the Concrete and Steel Section in connection with an investigation of mud jack materials using admixtures of lime, calcium chloride and fly ash.

Concrete and Physical Testing Section

This Section tested 9,808 samples, which required 26,396 tests and, in addition, accomplished the following:

A total of 50 field men from other highway divisions received training at the Laboratory at various times. This training covered the use of sieves, the making of Proctor Tests, Elutriation Tests and other tests useful to these men.

During this year, five (5) different air entraining agents were tested and evaluated. These tests consisted of the determination of the amount of air entrainment in batches of concrete and in the making and testing of cylinders for strength.

An investigation of a test was made using a zinc chloride solution to determine the amount of shale in aggregates. It was found that this would be excessively expensive if intended for routine testing, and also the value of our determination is questionable where aggregates can be evaluated on our service record.

In addition to the regular tests made on mud jack material, many additional tests were made using fly ash, hydrated lime and calcium chloride as additives. A considerable amount of this work was done in cooperation with the G.&W.H. Corson Company in an effort to evaluate the properties of fly ash when added to mud jack mixtures. In connection with this investigation, seven (7) field trips were made to various mud jack operations on Routes 25, S-26, 29 and 44, in order that practical comparisons might be made between laboratory mixtures and tests versus the necessary conditions in actual practice. A considerable amount of valuable information has been obtained and it is believed that continuance of this type of investigation will advance the comparison of laboratory tests and field practice and eventually improve the operation in the field.

Cooperation was rendered to the Bituminous Sub-Division in the testing of specimens for Laboratory Investigation 47-3.

To aid in various investigations being carried on by Mr. Wm. Van Breemen, the Sub-Division made and tested 90 concrete cylinders, 14 beams (4" x 4" x 24"), 7 tests on dowel bars including the casting of concrete specimens required, the casting of the concrete required for the 14 pull-out specimens and, in addition, 12 tensile tests of reinforcing bars.

The long-time study of 6" x 6" x 24" beams (see Laboratory Investigation 45-8) for growth and surface scaling has been continued without notable changes.

Freezing and thawing and wet-dry tests were made on Soil Cement Cores cut from the North Pemberton Road, Burlington County, and reported.

This Sub-Division has worked in very close cooperation with the Soils Division in testing samples submitted by them for the purpose of prospecting for materials or investigating sub-surface conditions. Direct contact between this Sub-Section and the Soils Division has been maintained by submitting penciled reports directly to the Soils Division and retaining a copy of such for our files. This method has proven very advantageous, as it furnished the desired information almost immediately after the completion of the tests and also relieved the load being carried by the Stenographic Section.

Members of this Sub-Section attended various meetings during the year as follows:

Joint Research Committee	7
Suggestion Committee	15
Lectures (Highway)	3
Bell Telephone Laboratory	1
American Concrete Institute	3 Days
Highway Research Board	4 "
A.S.T.M., Atlantic City	2 "
Chemical Show, New York City	1 Day
Freeze-Thaw Committee of Joint Research Board	2
Mr. O. Porter on Triaxial Shear Apparatus	1

Receiving Room

This Section handled approximately 5,000 more samples than in 1948. The reports were generally kept up to date with the exception of a few short periods. This was due to the increased personnel available, aided by the fact that 1,148 cores did not have to be given serial numbers and cleared through this Section.

Field Testing and Inspection

The Senior Division Material Inspectors were assigned to the same territories as of previous years. In addition to their routine duties, the increased amount of which is shown in the accompanying Statistical Supplement, they made such other inspections and investigations as were directed by this office, or as deemed necessary on their own initiative.

Two (2) Division Material Inspectors were assigned to the measuring of air in freshly mixed concrete. These men also inspected concrete block at such times as this work would not interfere with their air entrainment duties.

A Material Inspector was assigned to the Cement District to assist the Division Material Inspector in charge. This has greatly increased the efficiency of the Portland Cement Inspection.

Pipe, Steel and Castings

The activities of this Sub-Division were greatly increased this year as shown by the quantities of materials inspected and shipped in the accompanying Supplement.

Core Drill Section

There were 1,148 cores cut from pavements, which is approximately 130% of the previous year.

FIELD

	First 6 Months	Second 6 Months	Total
I. AGGREGATES			
a. Field Tests:			
1. Gradation	366	430	796
2. Moisture	540	662	1,202
3. Voids	379	412	791
b. Samples to Laboratory:	93	69	162
c. Tested at Point of Production:			
1. Concrete Sand, Tons	9,139	38,321	47,460
2. Broken Stone, Tons	28,655	13,399	42,054
3. Washed Gravel, Tons	-	56,925	56,925
II. CONCRETE FOR CONSTRUCTION			
a. Air Entraining Tests	775	853	1,628
b. Batch Plants			
1. No. Plants Set	163	204	367
2. No. Classes Concrete Set	304	375	679
3. No. New Plants Inspected	16	4	20
c. Mixers Calibrated	19	14	33
d. Test Slabs	25	37	62
e. Test Cores - Concrete Pavement	425	723	1,148
III. MANUFACTURED ITEMS			
a. Cement			
1. Barrels Shipped	297,367-1/2	377,768-3/4	675,136-1/4
2. Bins Sampled	61	62	123
3. No. Cars Shipped	888	1,122	2,010
b. Clay Pipe			
1. Inspected, Ft.	6,870	3,679	10,549
2. Specimens to Laboratory	26	13	39
c. Concrete			
1. Block - Approved, Shipped	93,121	90,724	183,845
2. Crib - Units Inspected	1,889	1,289	3,178
3. Pipe - Inspected, Ft.	138,105	148,733	286,838
4. Specimens to Laboratory	195	205	400
5. Tests - Field on Pipe	148	140	288
d. Iron Castings			
1. Inspected - Lbs.	1,518,080	1,032,421	2,550,501
2. Specimens to Laboratory	62	44	106

FIELD (cont.)

	First 6 Months	Second 6 Months	Total
III. MANUFACTURED ITEMS (cont.)			
e. Reinforcing Steel			
1. Inspected - Lbs.	5,185,556	3,409,751	8,595,307
2. Specimens to Laboratory	358	342	700
IV. TRAVEL			
a. Mileage:			
1. Private Car	21,894	25,221	47,115
2. State Car	64,954	69,601	134,555
Totals	86,848	94,822	181,670

LABORATORY

	First 6 Months	Second 6 Months	Total
I. SAMPLES REC'D & TESTED			
Brick, Construction	19	24	43
Cement, Portland	856	670	1,526
Concrete Block	36	30	66
Concrete Curing Material	22	28	50
Concrete Cylinders	1,049	1,590	2,639
Fill Material	100	58	158
Gravel, Road	312	507	819
Gravel, Washed	374	645	1,019
Gray Iron Test Bar	32	22	54
Pipe, Concrete	143	161	304
Pipe, Iron, Clay, etc.	23	29	52
Sand, Concrete	467	638	1,105
Sand, Concrete, White	23	21	44
Sand, Misc., Drain, Mortar, etc.	292	314	606
Slag	3	2	5
Soil, Engineering	332	374	706
Steel, Rein. Bar, Fabric, Dowel	130	123	253
Stone, Concrete, Screenings, etc.	945	1,631	2,576
Subbase Material	174	202	376
Water for Concrete	1	-	1
Wire Rope	12	24	36
Misc., Mud Jack, Cinder, Grits, etc.	70	25	95
	5,415	7,118	12,533
Pavement Cores - No Serial Numbers	425	723	1,148
Total Samples - Engineering Sub-Division	5,840	7,841	13,681

In Some Cases, Samples Consist of Several Specimens.

LABORATORY (cont.)

	First 6 Months	Second 6 Months	Total
II. CONCRETE & STEEL SECTION			
a. Samples Tested	4,481	6,485	10,956
b. Tests Made	9,217	17,179	26,396
III. SAND & CEMENT SECTION			
a. Cement			
1. Bins Tested	61	62	123
2. Samples Tested, Bin	848	652	1,500
3. Barrels Tested, Bin	-	-	734,600
4. Barrels Rejected, Bin	-	-	18,800
b. Total Samples Tested	1,369	1,356	2,725
c. Total Tests Made	16,966	18,536	35,502

III. BITUMINOUS FIELD INSPECTION SUB-DIVISION

This Sub-Division is charged with the following:

1. The inspection of the preparation of bituminous concrete and sheet asphalt at the point of production.

2. The inspection of bituminous materials, such as asphalts, tars, etc. at the point of production.

3. The recording and tabulating of bituminous materials used throughout the State, including the calculation of the bituminous application tickets to a basis of 60°F. for final payment.

4. The calibration of distributor trucks used for the application of bituminous materials.

5. General activities.

Inspection of the Preparation of Plant Mixed Bituminous Concrete Surfaces

The following is a summary showing the quantities of bituminous concrete and sheet asphalt mixtures that were inspected during preparation for and delivery to 199 separate projects:

a - New Construction		
State & Federal Aid	884,713 sq. yds.	107,730 tons
State Aid & Federal Aid Secondary	1,175,720 "	138,336 "
Total	2,060,433 sq. yds.	246,066 tons

b - Maintenance	
State	37,668 tons
County Repairs	40,266 "
Not State Work	1,313 "
Total	79,247 tons
Grand Total (New Construction & Maintenance)	325,313 tons

This total tonnage is an increase of 95,167 tons, or 41% over that for 1948. The tonnage inspected during the 1948 Season was the peak year for this type of work up to this year. This increase is due in part to Federal Aid grants on our Secondary System and additional State Aid to municipalities.

A record of each of the projects in which this material was used is on file at the Laboratory. A compiled record of the tests on the same is made to the proper highway authority concerned before any payment is made to the contracting parties.

Inspection of Bituminous Materials at the Point of Production

An inspector is still maintained in the New York District for the purpose of inspecting bituminous materials, such as tars, asphalts, road oils, etc. at the

point of production, but we were unable to assign an inspector to the Philadelphia District because of the lack of personnel.

The testing and inspection of bituminous materials covered by samples submitted by the New York District Inspector, representing lots of various types of materials he has sampled at the various refineries, represents a total of 86,574,521 gallons. From this total lot, there was actually shipped 21.5% or 18,406,064 gallons for use on highway work in the State of New Jersey, which is an increase of approximately 874,000 gallons over that for the year 1948.

Recording and Tabulating Bituminous Materials

All of the bituminous materials used in State or State Aid Contracts, except those used for the preparation of bituminous concrete and sheet asphalt, are purchased on a volume basis determined at 60°F. All of these materials are applied at greater temperatures than 60°F.; therefore, calculations must be made to determine the quantity at 60°F. for final payment. To do this, delivery slips furnished with each truckload of material for such applications are submitted to the Laboratory where the calculations are made to determine the quantity at 60°F. The results of these calculations are submitted to the various Highway Department personnel concerned for the auditing of bills for payment. During this year, 14,725 loads of material, representing approximately 18,000,000 gallons of bituminous materials, were processed through the Laboratory as described above. The clearing of the records for this volume of material requires a great deal of the time of one clerk in order to expedite the furnishing of information for early payment.

Calibration of Distributor Trucks

A report on the method of procedure required by our Department for the calibration of distributing trucks used for the distributing of bituminous materials on State and State Aid Contracts was covered in detail in the 1947 Annual Report. These requirements are still in force.

During this year, 16 distributors were calibrated and charts prepared for the same.

All distributing trucks must have a certificate furnished by the Department showing that the truck has been officially calibrated by us. The calibrating work on all of these trucks is performed in conjunction with our State Department of Weights and Measures.

Other Activities

Because of the increased amount of work performed during this year, the activities of this Sub-Division were confined to routine work. However, work was started in an attempt to correlate service records on bituminous concrete and sheet asphalt pavements after they have been laid with a new type of laboratory test for determining the stability of mixtures prior to laying. It is hoped by this investigation that we may be able to predetermine the design of a mix with a given set of materials to give us the greatest stability and durability before the pavement is laid. It is further hoped by the development of such a method that we may be able to use some materials that are at the present time being rejected by our specifications.

To carry out this work, we have purchased a Marshall Stability Machine which has the advantage of being transported directly to the asphalt plant where the bituminous concrete or sheet asphalt mixture is being prepared and perform the tests at that point, in addition to its adaptability for use in the Laboratory. Because of this, we will be able to make tests upon the mixtures as actually prepared for delivery to a project. It will take some time for us to correlate the test results using this piece of equipment as against the road observations and inspections after the pavement has been under traffic for some time.

As noted above, the work required of this Sub-Division has been increasing by leaps and bounds, and, as I foresee the picture for the ensuing years, I believe that the work will be even greater than the past season.

I reported in the 1948 Annual Report, the assignment of one (1) Sr. Asphalt Plant Inspector to act as a roving inspector in an attempt to cover all projects, particularly to investigate the projects upon which bituminous concrete or sheet asphalt is to be laid prior to work starting, which gives us information for the proper design of a mixture for a given project. We found that one Sr. Asphalt Plant Inspector could not take care of the 199 jobs constructed this year. Therefore, another Sr. Asphalt Plant Inspector was assigned to this type of work. One of these Inspectors now takes care of the northern section of the State, north of Trenton, and the other Inspector the southern portion of the State, south of Trenton. This new arrangement has worked very satisfactorily, and it is felt that the benefits derived therefrom warrant this extra assignment. If we can secure the additional Asphalt Plant Inspectors we have requested, I feel that we should be able to cope with the asphalt plant work satisfactorily.

During this year, the stenographic work was relieved by the addition of a stenographer, and the routine work of processing bituminous material delivery tickets having been handled very satisfactorily with our present force, it is felt that we should be in a good position to take care of this coming year's work.

IV. BITUMINOUS SUB-DIVISION

This Sub-Division is charged with the responsibility of testing and conducting research and investigation on all bituminous materials such as tars, asphalts, emulsified asphalts, bituminous concrete and sheet asphalt mixtures taken at asphalt plants and pavement samples cut from roadways.

During the year, there was received a total of 6,704 samples, requiring approximately 18,000 individual tests.

Additional tests were made during the year under Laboratory Investigation 47-3, "Mineral Fillers for Use in Bituminous Concrete and Sheet Asphalt", a general description of which is given for this investigation under Section VI, "Research and Investigation".

In Section III, "Bituminous Field Inspection Sub-Division", mention was made of a new piece of apparatus for determining the stability of bituminous concrete and sheet asphalt pavements, which is known as the Marshall Stability Machine. This Sub-Division cooperated with the above mentioned sub-division in conducting tests using this piece of apparatus at the asphalt plants during the production of bituminous concrete and sheet asphalt on four (4) different jobs. This will give us data on the stability of such types of mixtures using this piece of equipment for the purpose of correlating these results with the actual service records for the roads upon which these particular mixtures were used. A description of this work will be found in the detailed report made by the Director of this Sub-Division and is on file in the Laboratory.

Another problem taking some of the time of this Sub-Division was in conjunction with Laboratory Investigation 46-1, "Bituminous Stripping", which will be described under Section VI, "Research and Investigation".

During the year, this Sub-Division also cooperated with Committee D-4 of the American Society for Testing Materials in the development of a "Proposed Method of Test for the Determination of the Bitumen Content in Bituminous Mixtures". This type of work is invaluable to us in that the ultimate aim is to standardize methods of testing so that there will be no question as to a result not being true because of improper procedure.

Appended to the report of this Sub-Division will be found a Statistical Supplement showing the various types of materials tested and the number of samples of each received.

Material Tested	Jan. 1 to Mar. 31	April 1 to June 30	July 1 to Sept. 30	Oct. 1 to Dec. 31	Total
Asphalt Cement	20	270	322	247	859
Asphalt Emulsion	-	3	12	1	16
Asphaltic Oil	21	273	379	142	815
Asphalt Plank	-	2	3	5	10
Benzol	3	8	4	3	18
Bituminous Concrete					
Type A & HA, Top Course	5	100	117	123	345
" " Bottom Course	1	34	12	4	51
" CA-BC-1	-	15	80	28	123
" CA-BC-2, Top Course	-	17	38	15	70
" " Bottom Course	-	4	18	7	29
" FA-BC-1	5	288	376	419	1,088
" FA-BC-2, Top Course	3	16	48	122	189
" " Bottom Course	3	14	45	60	122
" MA-BC-2, Top Course	-	-	153	14	167
" " Bottom Course	-	-	39	11	50
" Sand Seal	-	-	19	3	22
" SM, Top Course	7	67	96	60	230
" SM, Bottom Course	-	15	19	3	37
" T, Top Course	-	8	7	5	20
" T, Bottom Course	-	-	3	1	4
Bituminous Sand	6	53	43	31	133
Concrete Curing Compound	5	20	14	10	49
Cover Sand	1	18	29	4	52
Creosote	3	1	-	-	4
Curing and Subgrade Paper	1	5	-	-	6
Fuel Oil	19	17	10	18	64
Glass Beads	-	11	-	11	22
Liquefier	5	40	33	29	107
Liquid Joint Filler	8	7	6	15	36
Mineral Filler	10	53	62	43	168
Miscellaneous	8	16	6	8	38
Sheet Asphalt, Top Course	2	218	111	53	384
" " Bottom Course	2	103	45	28	178
Stone Sand	2	31	54	25	112
Tar	4	146	199	48	397
Tar Paint	2	8	6	10	26
Waterproofing Asphalt	4	7	7	1	19
" Fabric	2	8	4	-	14
Total	152	1,896	2,419	1,607	6,074

V. CHEMICAL SUB-DIVISION

This Sub-Division is charged with the making of chemical analyses on all materials requiring such analyses; with research, investigation, inspection and testing of traffic paints; and further with the inspection at the point of production of paints of all kinds used on the various structures erected under State or State Aid Contracts. Chemical analyses are required on such materials as portland cements, reinforcing steel, lignin binders, calcium chloride, paints, pipe, soils, etc.

There was received and tested this year by this Sub-Division a total of 866 samples, requiring 4,035 individual tests.

During this year, considerable time was required for the inspection of paints particularly at the point of production, and the investigation of the use of glass beads applied to traffic paint to produce better night visibility. In connection with the latter, a comprehensive investigation was made as described under Laboratory Investigation 49-5, "Glass Beads for Traffic Lines - Specifications for".

There has been added to the work of this Sub-Division the chemical tests required and the inspection at the point of production of air entraining agents now used in Air Entrained Concrete and there are apparently new types of agents being produced for this particular use which will require more time of this Sub-Division for the inspection thereof. Specifications have been developed for this material which require certain chemical analyses to insure our Department that the right type of this material is used in the production of Air Entrained Concrete. We make inspections of the manufacture of it at the point of production, and, if it is approved, it is placed in sealed containers, properly identifying it as approved material for use on New Jersey projects. During the year, we made an inspection of this material at three (3) different points of production, and approval was given for 2,475 gallons.

You will find appended to the report of this Sub-Division, a Statistical Supplement showing the number of gallons of the various types of paint inspected at the point of production, and a list of the number and various types of each of the materials tested.

During the year, 48,727 gallons of Ready Mixed Paint were inspected at the point of production and approved for use. Five hundred and fifty (550) gallons of paint were rejected as not complying with N.J. State Highway Department Specifications. Following is a list of the paint inspected:

White Lead Guard Rail	605	gals.
Traffic Paint	22,445	"
Traffic Paint, without pumice	10,280	"
Traffic Paint, Crosswalk	2,995	"
Red Lead Shop Coat	5	"
Red Lead-Graphite Primer	1,030	"
Red Lead & Graphite	4,070	"
Red Lead Field Coat	251	"
Black Graphite	4,205	"
Foliage Green	430	"
Red Lead Primer (alkyd)	2,316	"
Gray Intermediate (alkyd)	95	"
Total	48,727	gals.

Samples Received and Analyzed

Beads, Glass	12
Caulking Compound	2
" " Primer	1
Cement, Portland	127
" " Air Entraining Agt.	9
Calcium Chloride	5
Fly Ash	1
Fuel Oil	1
Insulation Board	4
Lignin Binder	29
Metal	1
Mineral Filler	5
Paint, Cement-Water	1
" Ready Mixed	194
" Driers	41
" Oils	16
" Paste	3
" Pigments	82
" Thinners	26
" Vehicles	16
Pipe, Wrought Iron	1
Preservative, Wood	6
Resin	11
Road Iron	1
Rope, Wire	31
Rubber, Chlorinated	2
Sand	2
Slag, Boiler	1
Soils	229
Stone	4
Tar	2
Total	866

VI. RESEARCH AND INVESTIGATION

The following is a brief outline of some of the research and investigation projects that were either concluded this year or are still being carried on. Other research and investigation projects which were concluded before this year have been reported in previous annual reports. The first numerals given in the Laboratory Investigations listed below indicate the year in which the investigation was started.

Laboratory Investigation 44-2. Portland Cement and Mortar Expansion Tests.

This investigation is still being continued using various types of aggregates in an endeavor to determine the growth or excessive expansion that might be caused by various types of aggregates using portland cements manufactured by different producers. In this investigation, 1" x 1" x 10" mortar bars are used. We are not ready at this time to draw any definite conclusions as to the value of this work or that it correlates the results with what happens in the actual placing of concrete on our highways.

This investigation has been expanded, as reported under Laboratory Investigation 45-8, given hereinbelow, using larger size specimens.

Laboratory Investigation 44-3. Method of Test for Cement Content of Hardened Portland Cement Concrete.

The status of this investigation is the same as reported in the 1948 Annual Report. We have done nothing further since the last report because of an investigation of this same subject now being initiated by Committee C-9, of the American Society for Testing Materials, which work we will follow very closely. It is the ultimate aim of this Committee to try to revise their present Standard Method of Test for Determining the Cement Content of Hardened Portland Cement Concrete. To date, they have not concluded this revision.

Laboratory Investigation 44-5. Guard Rail Post Deterioration. Suggestion No. 156.

Mention of this investigation has been made in previous reports. There is nothing further to report at the present time because of the fact that the posts installed on our Fernwood grounds had to be removed because they were in a location that interfered with operations connected with the construction of the new office building. They are now stored awaiting the finishing of the new office building, including the landscaping thereof. When this work is finished, we will have to select a location to reinstall these posts where they will not be disturbed for several years, as it will take at least 7 or 8 years for us to draw some conclusion as to the merits of one type of wood preservative used as against other types of preservatives.

Laboratory Investigation 45-8. Study of Reaction of Aggregates with Portland Cement in Concrete.

A description of this investigation was given in the 1948 Annual Report and observations of the specimens are being continued, but no conclusions can be drawn at this time and possibly it will take quite a few more years for these specimens to be exposed before any effect is noted.

Laboratory Investigation 46-1. Bituminous Stripping.

This investigation was first reported in the 1947 Annual Report. Nothing further has been done, to date.

As previously reported, Committee D-4, of the American Society for Testing Materials, is continuing its investigation with the ultimate aim of developing a standard method of test to determine the stripping characteristics of bituminous materials applied to various types of aggregates. The work of this Committee will be followed very closely, as it is hoped the method of test it develops will be of such a nature that it will give direct evidence of determining this characteristic of bituminous materials.

Laboratory Investigation 46-3. Joint Filler - Seal for Transverse and Longitudinal Joints in Portland Cement Concrete Pavements.

It was reported in the 1948 Annual Report that this investigation had been concluded and that we were ready to make a definite recommendation for a specification for a joint filler based upon this investigation.

However, since this investigation was initiated, quite an extensive installation of a similar type of thermoplastic filler, which is a combination of asphalt and rubber, was made this year on Route 25, Sections 10-A & 11-A, which did not corroborate the results secured installing the same type of material as was included under this investigation. Therefore, because of this fact, we are withholding our recommendation for the use of this type of material as a joint sealing compound.

Laboratory Investigation 46-4. Guard Rail Posts - Elm Lumber.

A report was made in the 1946 Annual Report of the starting of this investig tion, which included the installation of a series of Elm Guard Rail Posts on Route 29.

Inspections made of these posts during the year showed no signs of deterioration or rotting. It will probably take several years before these tests show any signs of deterioration.

Periodic inspections will be made of these posts.

Laboratory Investigation 47-2. Bituminous Concrete Type A Minus Liquefier.

This investigation is being continued, and, as reported in the 1948 Annual Report, the Maintenance Division expected to and did use a considerable tonnage of the "SM Special Mix" and we have every reason to believe that the results secured warrant the continuing of the use of this type of mixture.

It was placed this year on some very heavily traveled roads and the results secured are very encouraging, but I feel that we should have our observations continue for a period of at least two more years before we make any definite statements as to its acceptance for use.

Laboratory Investigation 47-3. Mineral Fillers for Use in Bituminous Concrete and Sheet Asphalt.

This investigation was first reported in our 1947 Annual Report, and investigations along the same lines are still being continued. However, because of the lack of personnel and equipment, we can only carry on this investigation during our slack season, which limits the time we have to devote to this work.

During the year, we started some further tests using various types of fillers and the aggregates we are using in the preparation of our own bituminous concrete mixtures, and we feel that the results secured will give us some very important information to develop a test to qualify mineral fillers as to their acceptability for use in the production of bituminous concrete and sheet asphalt.

Sub-Committee B-26, of Committee D-4, of the American Society for Testing Materials, is very much interested in developing a method of test that will enable us to qualify mineral fillers for use in bituminous concrete as well as determining the effect of water on bituminous coated aggregates by the so-called "Immersion-Compression Test", and we are keeping in very close touch with the work of this Sub-Committee.

Laboratory Investigation 48-1. Joint Sealing Compound.

This investigation was carried on using a bituminous material presented to us by the Presstite Engineering Company of St. Louis for the purpose of determining its suitability for use as a sealing compound for transverse and longitudinal joints in concrete highways.

Our tests upon this material showed it not to be suitable as a sealing compound for sealing the types of joints stated above.

Laboratory Investigation 49-1. Skid-Proofing Bituminous Road Surfaces Using Kentucky Rock Asphalt.

This investigation covers possible means of correcting the slippery condition that had developed on several of our bituminous concrete and surface treated pavements.

We had secured information that a product known as "Kentucky Rock Asphalt" could be used for this purpose. We made investigations of the use of this material by the State of Pennsylvania and it showed some promise of accomplishing the correction of such slipperiness as described above.

Mr. A.W. Muir, Superintendent of Maintenance of our Department, was interested in finding some method to prevent this condition and had made tentative arrangements to apply some of this material on our Route 35, between Red Bank and Eatontown. To date, nothing has been done on this or any other project, and I believe it is Mr. Muir's intention to try some of this material on the above mentioned project this coming year.

Laboratory Investigation 49-4. Rubberized Asphalt for Bituminous Mixtures.

There is quite an extensive promotional program being put forth in the United States to add natural rubber to the asphalt cement used in the preparation of bituminous concrete and sheet asphalt. The claims for the addition of this rubber are that it will increase the life of such pavements and make them less prone to slipperiness, or, in other words, it will raise the coefficient of friction between the automobile tires and the road surface.

Sections of such roads have been laid in various parts of the country. We have been informed that such sections were laid in Akron, Ohio, and in Virginia, and we are following very closely reports made covering the data secured on these particular roads. We have not laid any within our own State, and, until such time as the information developed on the roads noted above indicates that we would increase the durability and non-skid characteristics of our own bituminous concrete and sheet asphalt pavements, I think we should hold in abeyance the laying of any in this State.

Laboratory Investigation 49-5. Glass Beads for Traffic Lines - Specifications for.

The application of glass beads to traffic paint applied to our highways for traffic guidance and direction is becoming quite extensively used in other parts of the country for the purpose of illuminating such lines at night for better visibility. We believe that the application of these beads is warranted, particularly on curves and on grades, and, when the price of the same is reduced, we might recommend that these beads be used on all lines painted.

In order to attempt to draw a specification for the purchase of glass beads for this purpose, arrangements were made through our Purchasing Department for the purchase of a small supply of beads from several manufacturers thereof. We secured 11 different samples of these beads supplied by 7 different companies, together with 5,000 gallons of a white traffic paint. On July 26th and 27th of this year, we applied this paint and beads on Route 25, between Collingswood and Westville. In the experiment, stripes of the traffic paint without beads were included. Observations were made of this application up to the end of this year and enough information has been obtained from this experiment, together with some Laboratory work, to draw a tentative specification for glass beads for application to traffic paint.

During the coming year, the State will purchase about 60,000 lbs. of these beads for application to some of our traffic paint, and the same will be observed from time to time to secure further information.

This investigation developed the fact that a great deal more additional work has to be done in connection with this problem to perfect our specifications for the bead itself, the amount to be applied per gallon of paint, and possibly a revision of our paint specifications when glass beads are to be used.

VII. SOCIETY AND ASSOCIATION ACTIVITIES

My connection as the Department's representative with the various societies and associations concerned with the development of specifications and methods of tests for materials used in highway and bridge construction was continued during the year. Encouragement should be given to the continuation of these connections, as the information we secure is invaluable to us for the purpose of developing better specifications and methods of tests for materials.

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I would like at this time to commend the entire personnel of the Testing Laboratory for the manner in which they performed their assigned duties, particularly at times under trying conditions.

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SPECIFICATION NO. 4-1-50

FOR THE CONSTRUCTION

OF

THE ROAD TO GOOD WILL TO MANKIND

(CLOSELY CEMENTED TYPE)

Foundation:

The foundation of the road to friendship must be deep and strong and capable of carrying any load placed upon it, otherwise it will fail. Remove any undesirable portions and replace with good, honest materials. When you are sure the foundation is perfect, stabilize into a solid enduring unit with two gallons per square yard of sincerity.

Surface Pavement:

Upon the carefully prepared foundation place 140 pounds per square yard of sturdy good will and roll it until it locks into an unwielding unit, being sure to fill the base voids with 12 pounds per square yard of chips of friendliness.

Penetrate with 1/2 gallon per square yard using the binder of brotherly love.

Spread 25 pounds per square yard of the keystone of unselfishness which will firmly lock the well prepared base rock.

Penetrate with 1/2 gallon per square yard of the binder of happiness.

Carefully guard against any surface voids by tightly rolling in 20 pounds per square yard of the chips of understanding.

Seal Coat:

To tightly seal in this well-built road of good will to all mankind, apply 1/4 gallon per square yard of devotion and cover liberally with the sand of time.

Consolidate this splendid construction with a final rolling of determination

The road is now ready to use and is guaranteed to never wear out during countless years under the grinding traffic of adversity.

(Anonymous)

Respectfully Submitted,

Fred H Baumann

Fred H. Baumann,
Supervising Engr., Testing Laby.

APPENDAGE OF
AND
LEGEND FOR
PHOTOGRAPHS

The photographs attached, and the accompanying legend thereof, are for the purpose of attempting to show some of the very crowded conditions existing at our Laboratory, and the very grave need for consideration of the expansion of our physical facilities.

No. 1

This is a photograph of our Soils Laboratory, packed into a room 8' x 15'. At least four times this floor space should be allotted for our soil testing and investigational work.

There are numerous other pieces of equipment used for soil testing which have to be crowded into nooks and corners in other rooms of the Laboratory. For instance, the drill press used for powdering soils is in the Carpenter Shop, and the Consolidation and Shear Testing equipment are in the Compression and Concrete Preparation and Aggregate Room.

No. 2-A

This photograph shows one corner of the Compression Testing Room in which the office is located. This office is only 8' x 12' and is not anywhere near enough room for the Director of this Section of the Laboratory and his assistants to properly perform the work required of them.

The congestion of pieces of equipment in front of this office shows the need for more space.

No. 2-B

This is another photograph of the Compression Testing Room, showing our 400,000 lb. Compression Machine and the controls therefor.

In the right-hand corner are two pieces of equipment for soil testing:

(a) For Consolidation Tests on large samples.

(b) For Direct Shear Tests.

These pieces of equipment must be moved from this location whenever they have to be used. They are very delicate, as a part of the equipment are Ames Dials recording to 0.0001". These should be kept free from dust; also, the Compression Machine can not be operated while these pieces of equipment are being used because the vibration caused by the compression test affects the results secured.

No. 3-A

This is a photograph taken of the southwest corner of the Concrete Preparatio and Aggregate Testing Room, where hand-grading of aggregates is performed. Sometimes it is necessary to have two or three men attempting to do work in this corner.

APPENDAGE OF
AND
LEGEND FOR
PHOTOGRAPHS
(cont.)

No. 3-B

This is a photograph of the southeast corner of the same room (3-A), where a sound-proof closet has been constructed in which a large noisy aggregate screening apparatus operates. The top of this cabinet is used to store some odds and ends of equipment and supplies which should be stored in a separate storage room.

The piece of equipment directly in front of the sound-proof closet is an electrically controlled drying oven, and the one to the left thereof is a gas heated drying oven.

No. 3-C

This is a photograph taken of the northeast corner of the same room (3-A), showing the concrete mixer used for fabricating concrete specimens. The molds on the floor are for the purpose of forming concrete plugs for the replacement of cores drilled from concrete roads. This leaves a rather small area for fabricating these specimens.

No. 3-D

This is a photograph of the northwest corner of the same room (3-A), which shows a very congested condition.

On the table to the left are four (4) pieces of consolidation equipment for testing soils which should be in a separate room free from dust and vibration which might be created by the large Compression Testing Machine in the adjoining room. This space should all be available for aggregate gradings and concrete testing. The piece of equipment on the right-hand end of the table is an Air Meter used for the determination of the air content of freshly made concrete.

No. 4

This is a photograph of the southwest corner of the Capping Room (12' x 16'). In this room all the concrete cylinders and cores are capped and prepared for determining the compression test.

No. 5

This is a photograph of the 7' x 14' room used for recording the receipt of samples and preparing reports for tests, which is becoming very congested for the expanded amount of work we are being required to do.

No. 6

This is a photograph of the hallway on the first floor, looking north from the base of the stairway leading to the second floor, which shows the condition existing here at the Laboratory as to the lack of space for the storage of equipment and supplies. This clutters up our hallway very badly.

APPENDAGE OF
AND
LEGEND FOR
PHOTOGRAPHS

(cont.)

No. 7

This is a photograph of the Boiler Room in which is located the fuel oil burning boiler for supplying heat and hot water for the Laboratory and steam for the Air Conditioned Room. This very clearly shows the need for physical expansion here at the Laboratory, as we have been trying to utilize every open space for placing various kinds of equipment that we are required to use for testing. This makes a very bad condition and creates a fire hazard by having to place equipment in this Boiler Room. It is necessary that this heating plant be operated the year round for the purpose of providing steam which is required for the air conditioning apparatus controlling the temperature and relative humidity of our Air Conditioned Room. I believe an auxiliary plant should be considered for operation during the summertime to provide steam for this purpose.

No. 8

This is a photograph of the Pump Room, adjoining the Boiler Room, in which several pieces of equipment for testing have been installed because of no other available place for them. In this room is located the vacuum pump for the heating system, individual suction and pressure pumps for supply to the Laboratory, in addition to a Page Impact Testing Machine, Dorry Hardness Testing Machine, and a Lap Grinder for grinding samples for test.

No. 9

This is a photograph of the larger Chemical Laboratory, upon the benches of which are located several types of ovens which take up bench space which should be available for the work required in this Laboratory.

No. 10

This is a photograph of the Balance Room and Office for the Chemical Laboratory which shows the condition that can exist when three (3) men have to be at the balances at the same time weighing material, and the very close quarters that the Director of the Chemical Laboratory has for his work.

No. 11

This is a photograph of the Bituminous Laboratory in which the testing of asphalt cements, tars, etc. is performed, which shows a very cluttered condition and the lack of space for the location of the pieces of apparatus required for the testing of these materials.

No. 11-A

This is another photograph taken from another angle in the same room (11), which also shows the very cluttered up and congested condition existing in this Laboratory.

APPENDAGE OF
AND
LEGEND FOR
PHOTOGRAPHS
(cont.)

No. 12

This is a photograph of the Balance Room and Office of the Director of this Sub-Division of the Laboratory, showing the very congested condition which exists. This shows only about two-thirds of the room which is about 8' x 15' long. At the right is a door leading into another room which is not shown. The men working in this latter room must walk through this Balance Room for the purpose of preparing samples for test, which creates a great deal of confusion and interference in this Balance Room.

No. 13

This photograph shows some investigational work on bituminous concrete pavements which has to be done in the room located on the roof of the Laboratory Building where the fans are installed for ventilating sections of the Laboratory. We should have some space available to do work of this kind and not have to try to clean out a corner here and there to rig up the necessary apparatus and provide space for investigational work of this kind.

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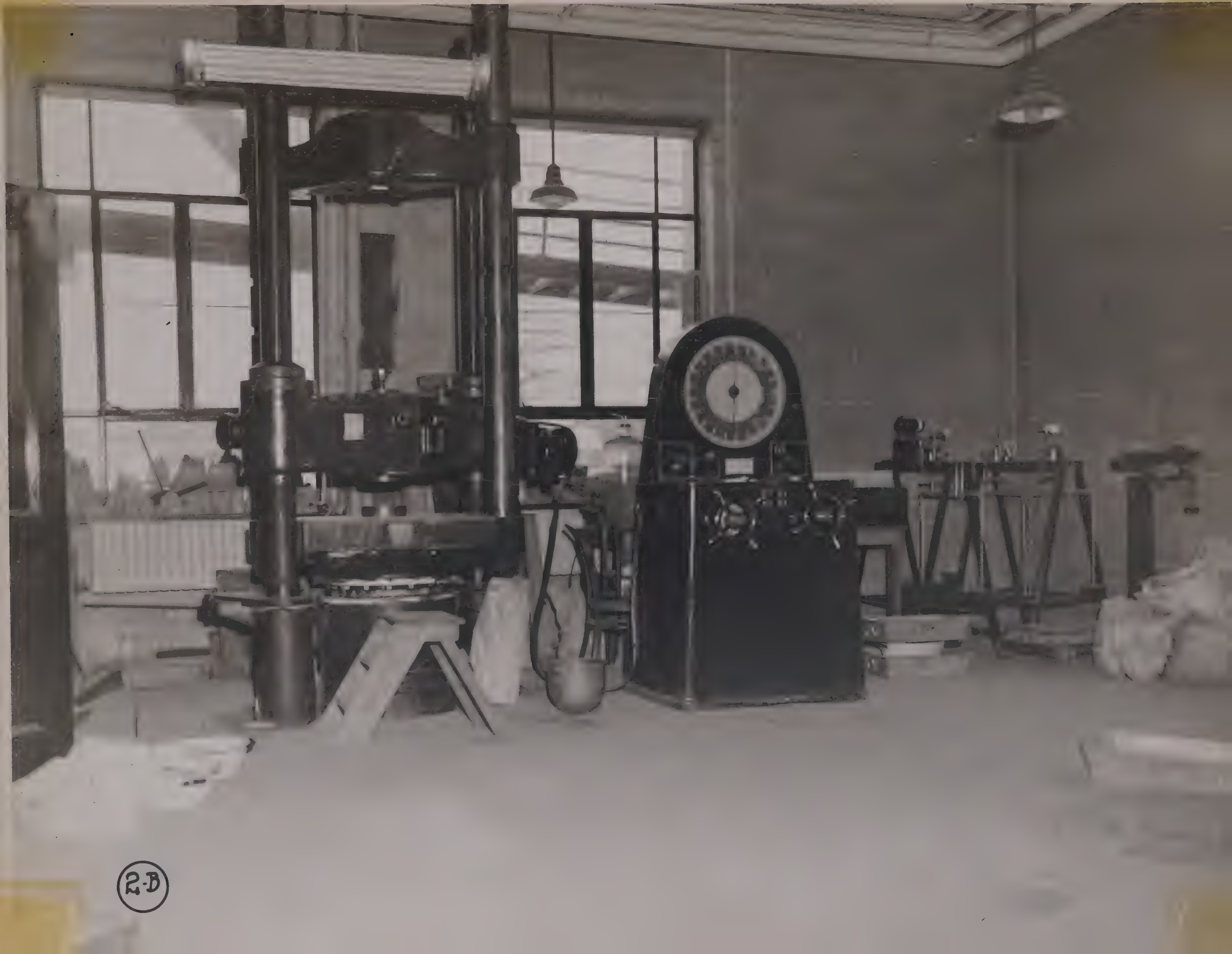
In the Report of 1941 by Sidney Goldmann and Thomas J. Graves, covering recommendations as to "The Organization and Administration of the New Jersey State Highway Department", the following is noted on page 592:

"Consideration should be given to enlarging the building now used by the Laboratory Division at Fernwood. The need for such expansion has been recognized in the Department for the past few years. More space will undoubtedly be required if the recommendation concerning the establishment of a Research and Testing Bureau and an extended research program is adopted. This program will, of course, require additional laboratory equipment and a somewhat larger staff."

As per this recommendation, the need for the expansion of our physical facilities was recognized as far back as 1941.

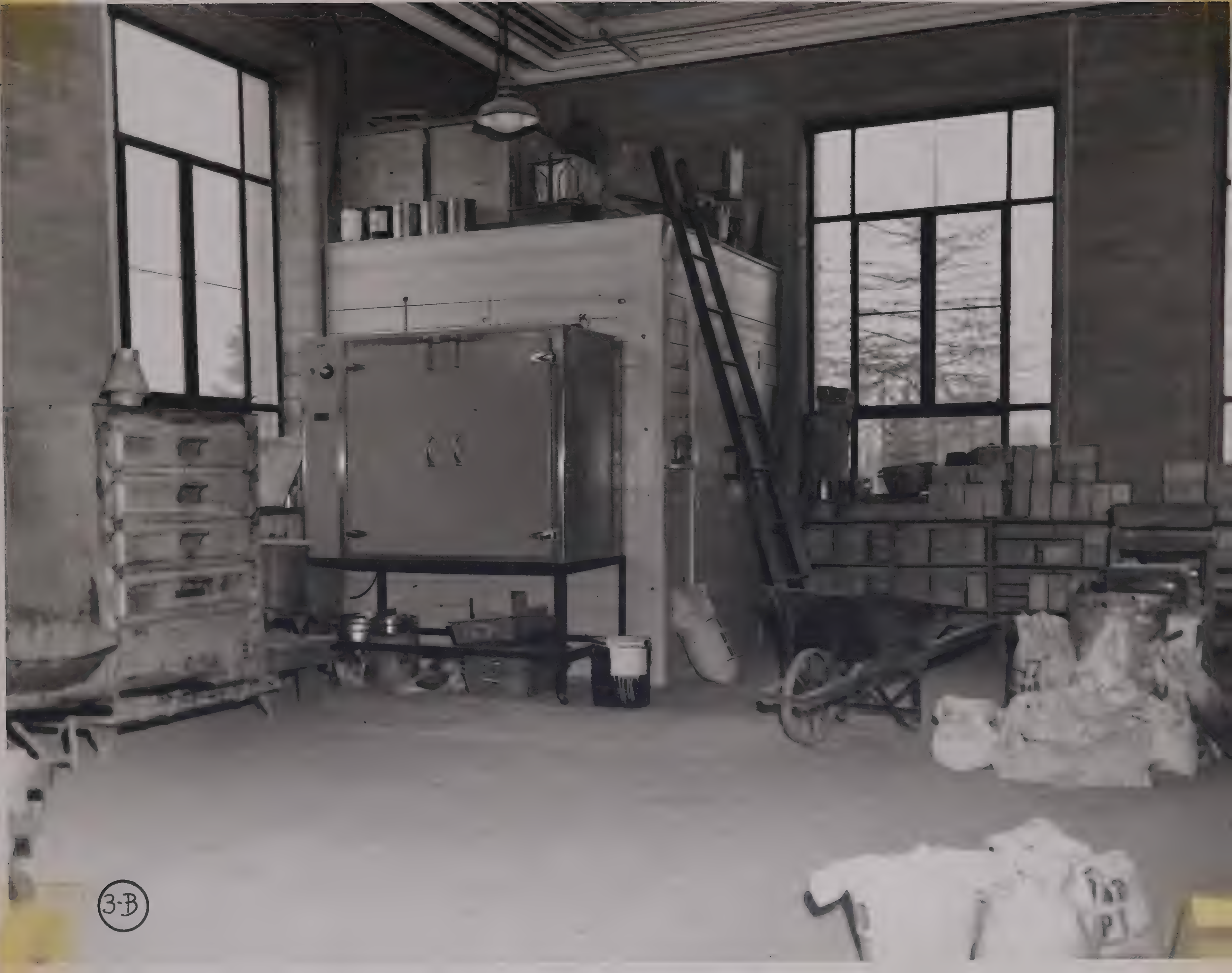
①

2-A

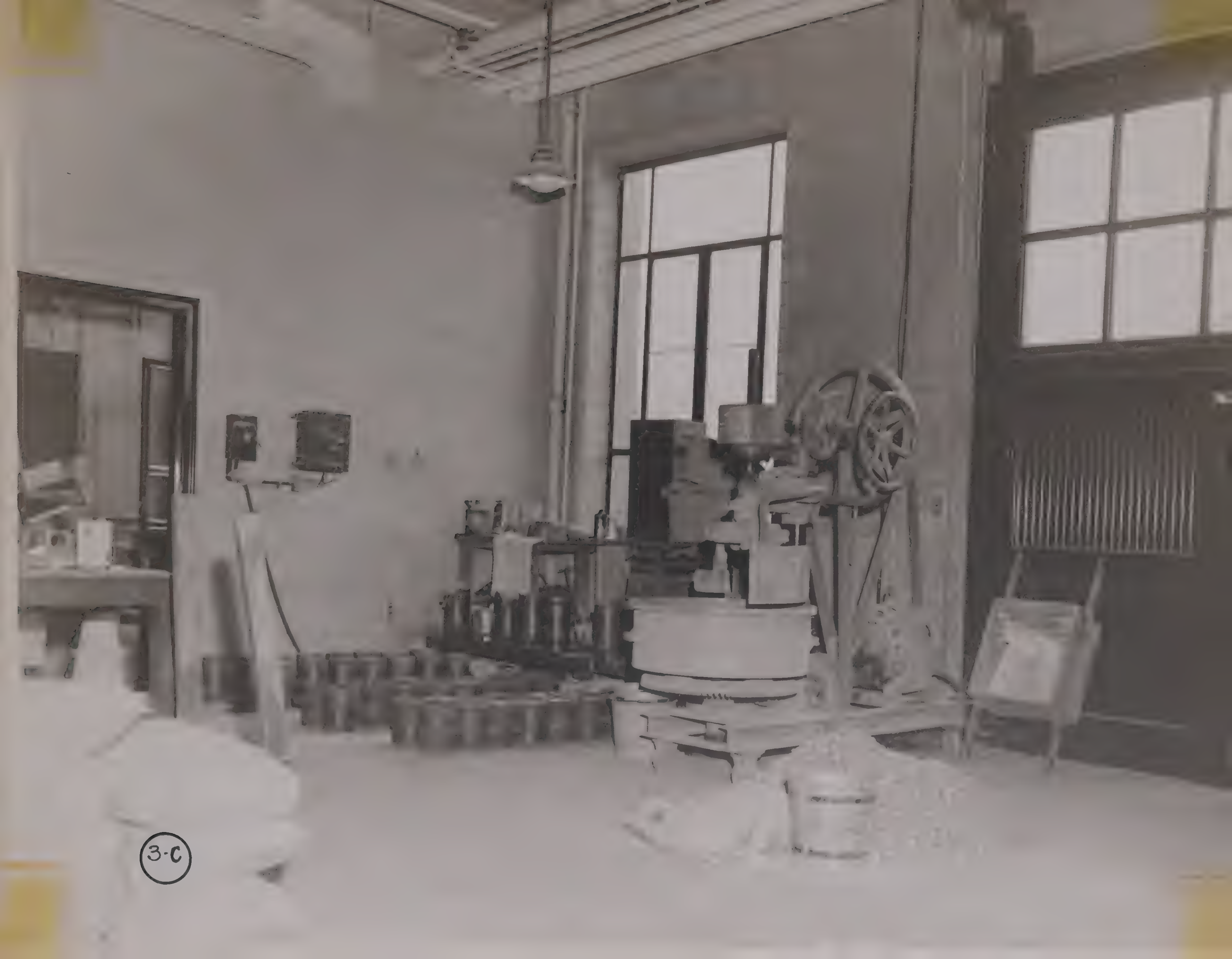


2-B

3-A



3-B



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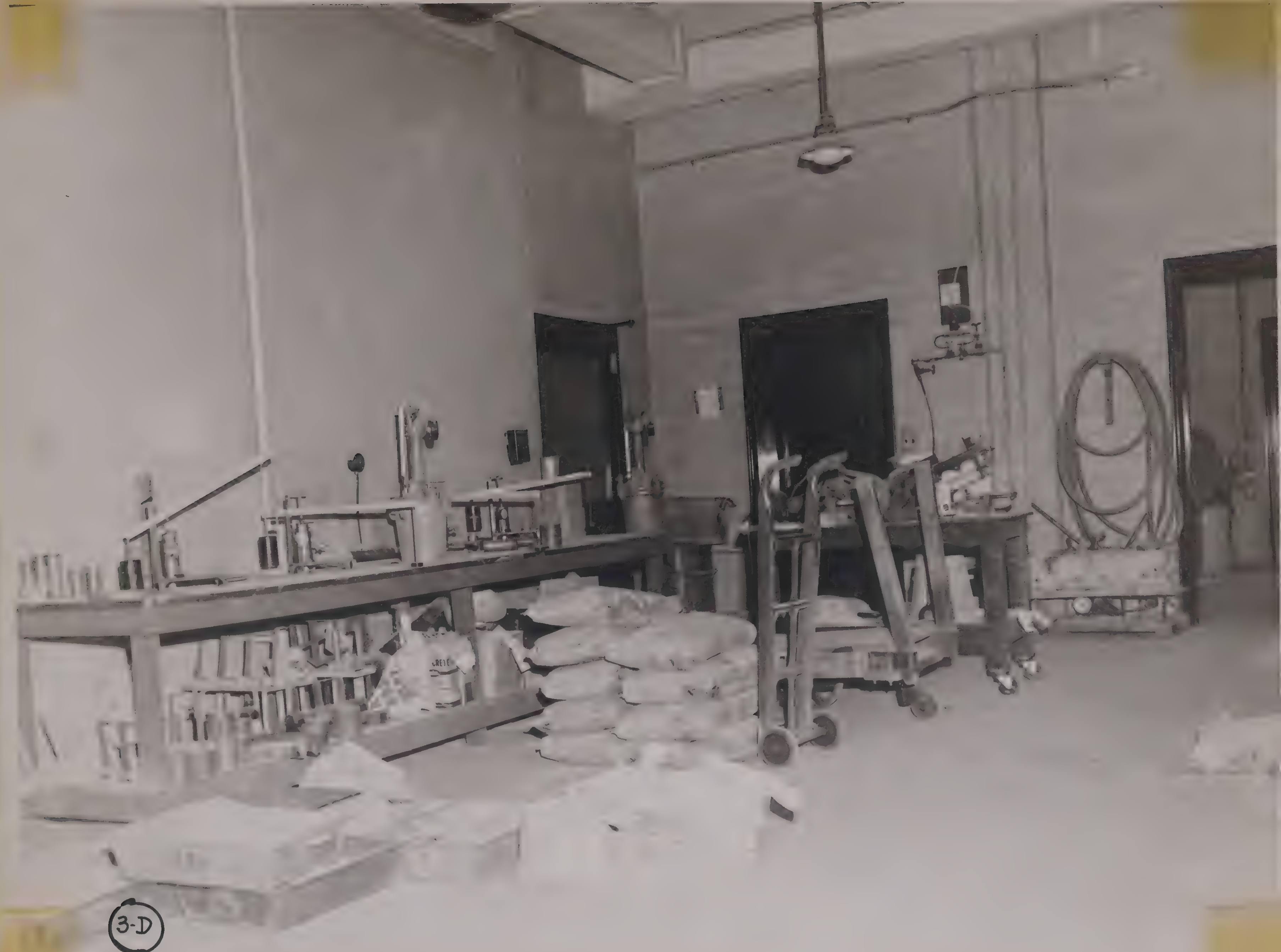
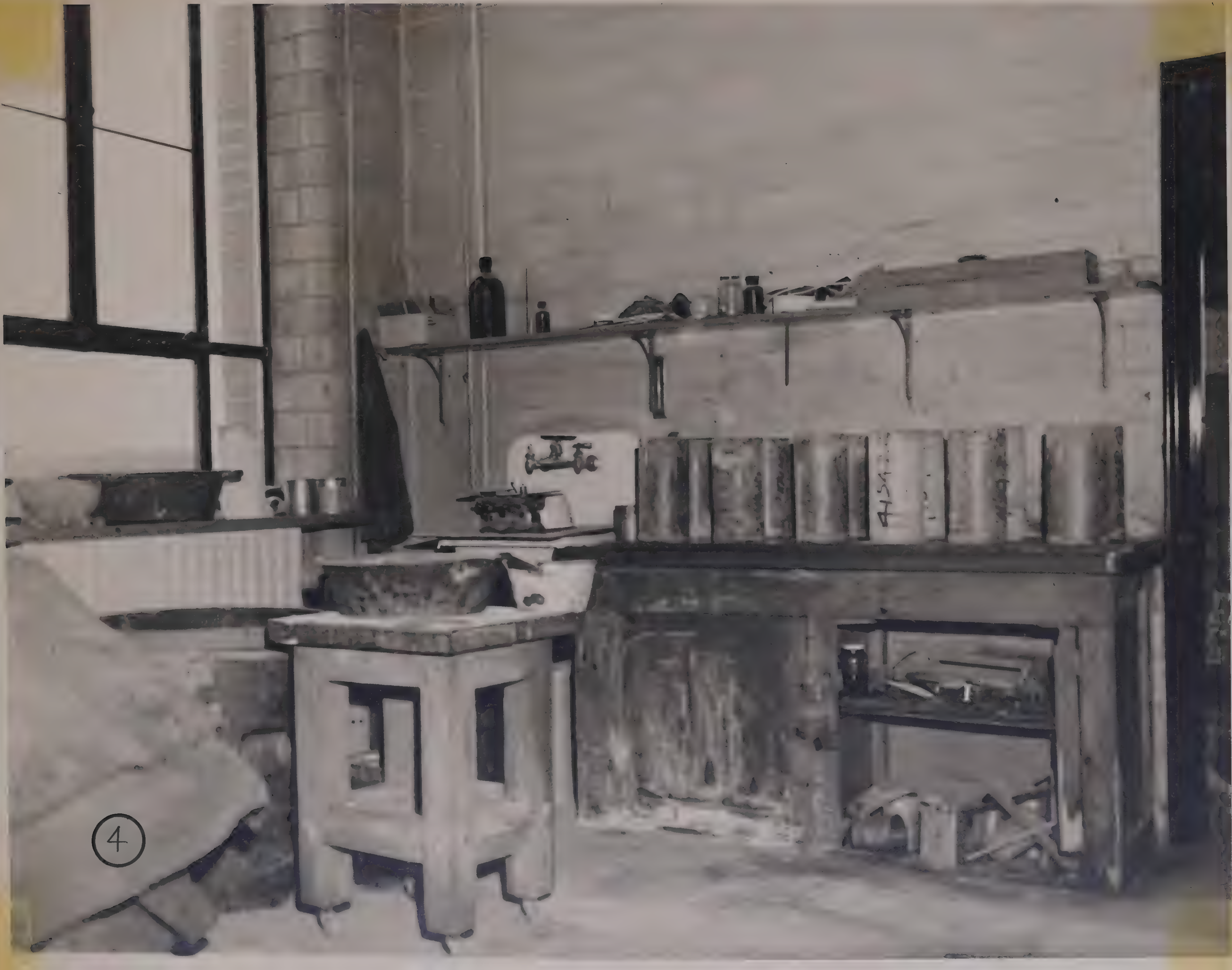


3-D



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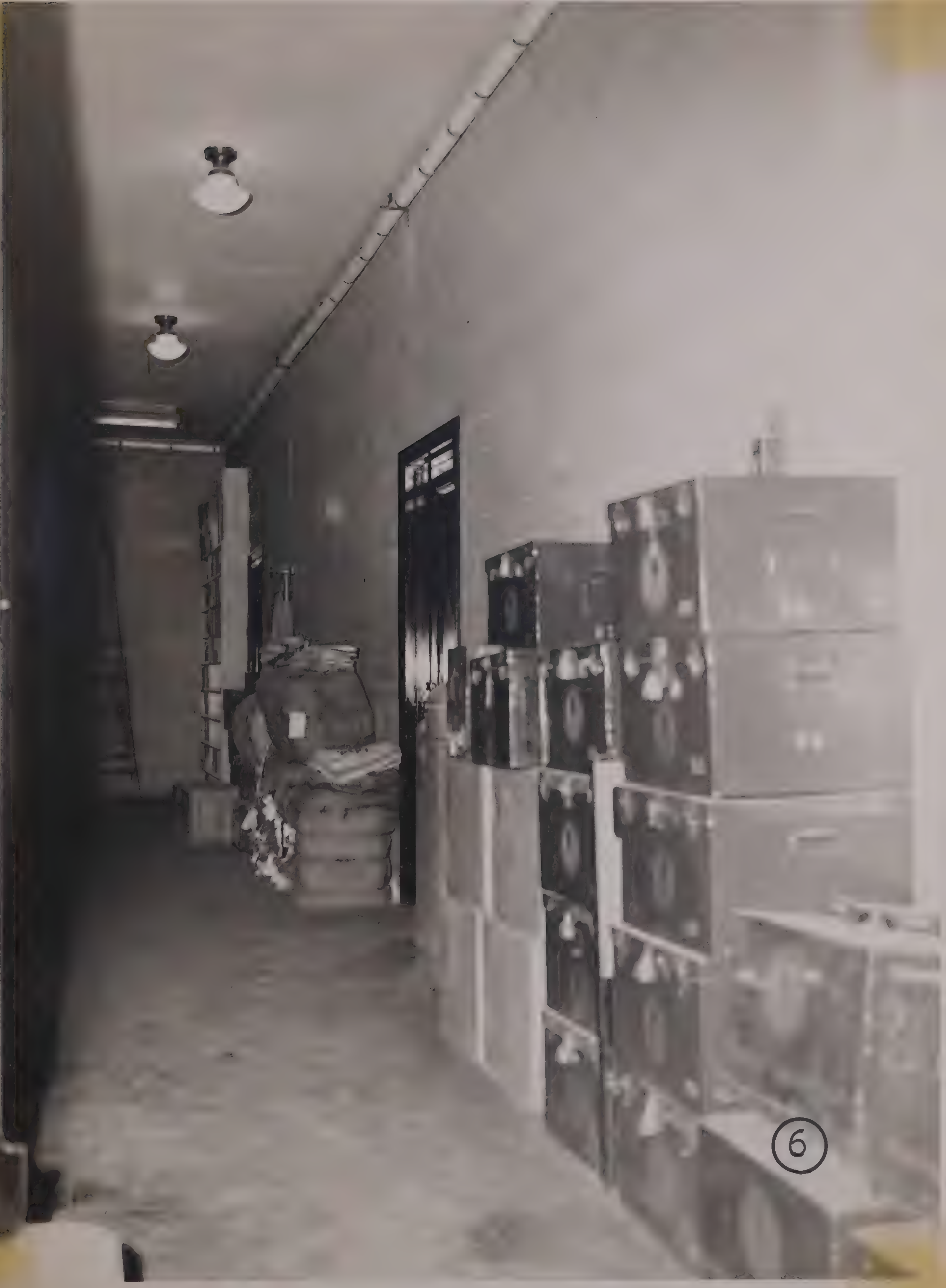

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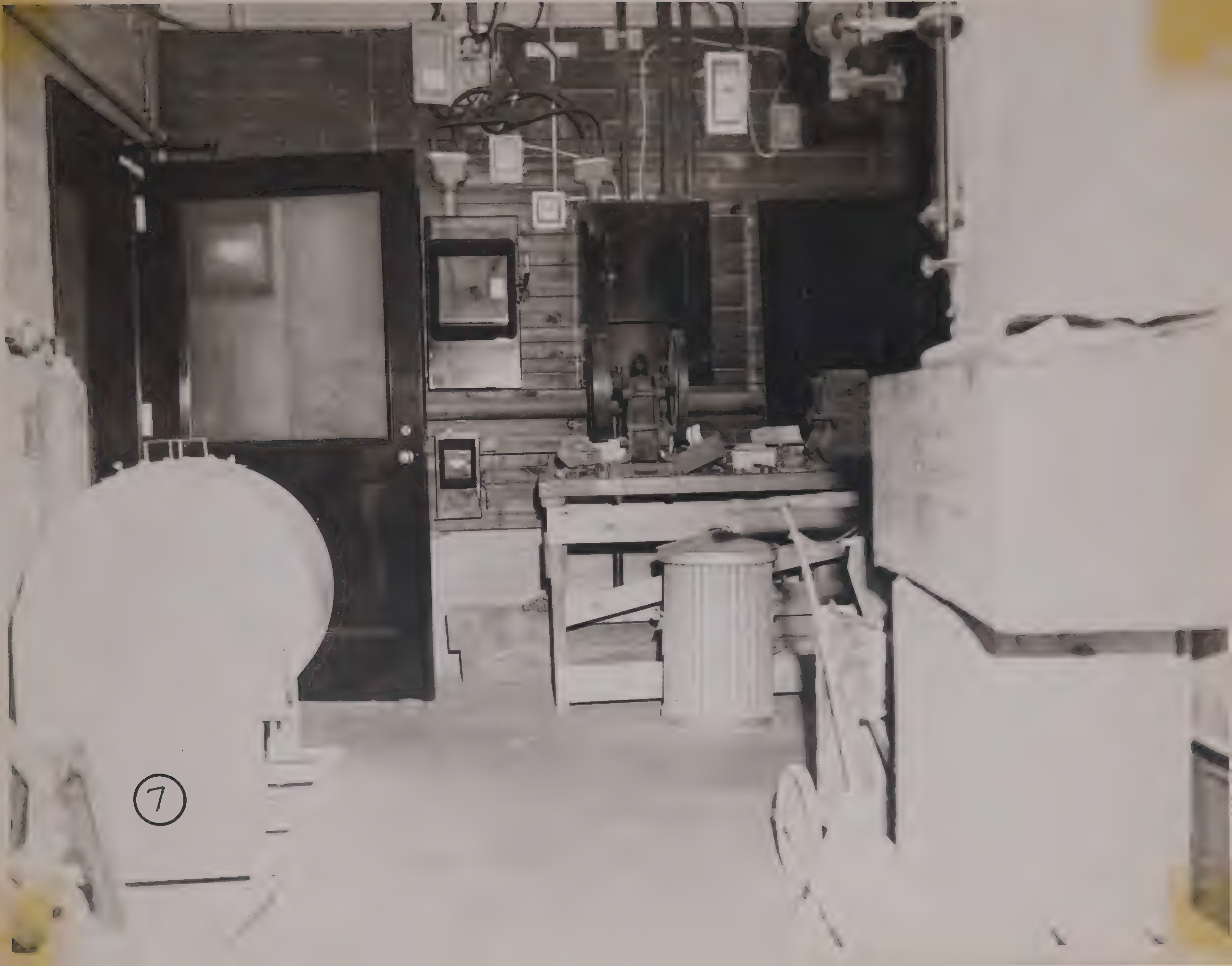
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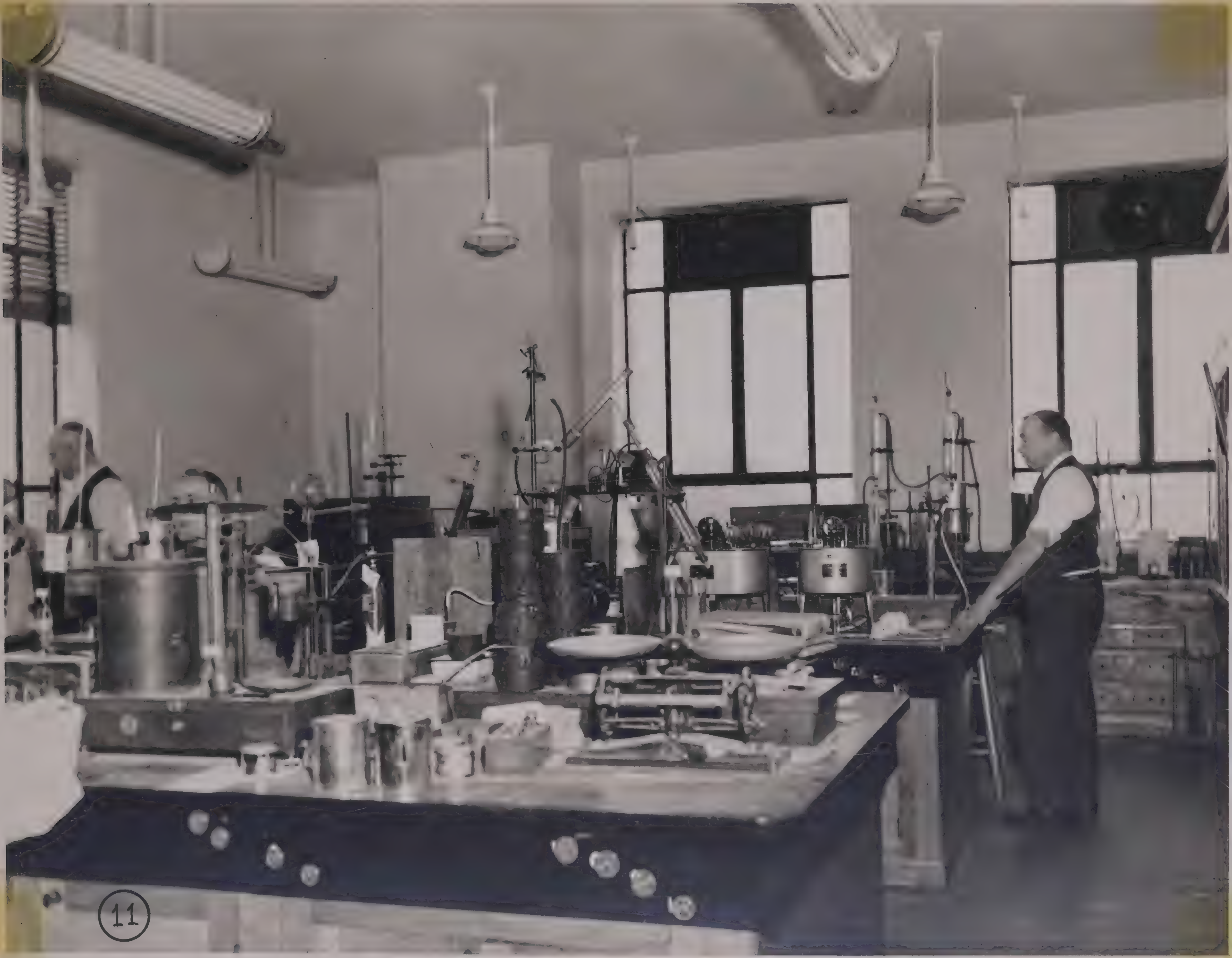

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11-A

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